Saskatchewan
Agriculture
and Food

Forage crop recommendations 1992

10 Steps to Successful Seeding

1. Careful preparation of land, appropriate clean equipment and seed are essential for successful forage seeding. Moisture is a critual factor: establishment failure can occur during dry periods even with excellent seeding techniques.

2. Seed shallowly — for most forages, 1/2 - 1 inch (1-3 cm) deep.

3. Seed into a firm seedbed. Clean, unworked stubble land is excellent. Fallow land should be worked shallowly, followed by harrowing and packing prior to seeding. Drills should not penetrate deeper than 1 inch (3 cm).

4. Choose a seeding implement that can deliver low seeding rates without bridging or plugging, and one that has good depth control. Discers are generally not acceptable.

5. If necessary, use herbicides to control winter annual weeds (see *Chemical Weed Contol in Cereal, Oilseed, Pulse and Forage Crops*).

6. Use the seeding rates on page 6. As a starting point, set the drill to deliver 1 bu/acre on the wheat scale. The ideal rate is 20-30 seeds per foot of row. Check the seeder by running over a hard surface and counting seed. (For calculating seeding rates, see page 16.)

7. Many grain drills are not designed to handle the low seeding rates required for forages. Instead, use a grass seeder attachment or seed through the fertilizer box. Small or light seed may be seeded more successfully by using coated seed or by using a carrier such as a) up to 15 lb/ac of 11-55-0 fertilizer (do not use with inoculated legumes); b) cracked grain; or c) horticultural vermiculite. Agitation will be necessary.

8. Wide-spaced or alternate-row seeding can be done by taping or covering the drill openings not required, followed by either a) seeding legume through forage seed or fertilizer box and grass through the grain box after diluting as step 7; or b) dividing drill box into compartments using cardboard dividers and tape.

9. Companion crops usually reduce subsequent yield of forage, depending on moisture availability. Low companion crop seeding rates (eg. half of normal) in cross-row or alternate-row seeding will minimize competition. Companion crops are best cut early for hay, leaving a tall (6-8 inch) stubble. Seeding companion crops with forage in the brown soils may reduce the chance of obtaining a good stand of forage.

10. Be patient. Complete establishment may take two growing seasons.

Remember: Seeding method is the most important factor in successful forage establishment.

Seeding Dates

Forages should be sown to coincide with moisture and weather conditions that will help germination and establishment. In general, perennial forages may be sown at three different times of the year.

Spring Seeding: This is usually the time when forage plantings are most likely to be successful. Generally soil moisture conditions are good. About 15 to 30 cm of moist soil is considered adequate for establishment. In the Brown and Dark Brown soil zones this time period will be from early April to mid-May. In the Black and Grey Wooded soil zones forage seedings may be successfully completed as late as mid-June. Usually early seeding is best, but consideration must also be given to field conditions, weed control and potential insect problems.

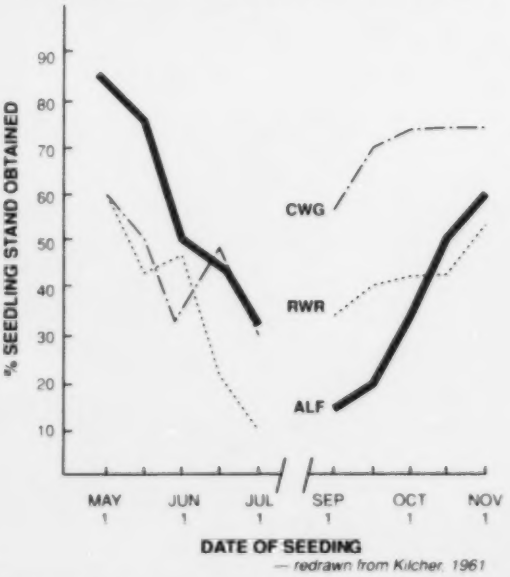
Late Fall Seeding: Seeding forage crops from October 15 until freeze-up generally ensures that no germination will occur until the following spring. Soil moisture conditions will likely be favourable from the infiltration of winter snow melt. There is often more time in late fall than in early spring to prepare appropriate seeding equipment and to calibrate and set it for forage crops. Another advantage to 'dormant' seeding is that some land areas may not be assessable in the early spring, eg. land subject to flooding, saline areas or peaty soils that remain wet in the summer. On the other hand, some crops such as sweet clover cannot be sown successfully in the late fall. Also, land may be subject to cracking and poor germination may then occur.

Early Fall Seeding: In some years there may be a 'window of opportunity' to seed forage crops in the early fall. Growing conditions must be correct for quick establishment as the plants must be developed to a stage to survive the winter. Seedling legumes are much more susceptible to winterkill than seedling grasses. This requires that alfalfa be sown by mid-August. There is little information on seeding legumes other than alfalfa at this time of year. Grasses may be sown as late as September 10 in the Brown soil zone. Insects such as grasshoppers can be a threat to seedling forages in the fall.

Row Spacing

Row spacing ranges from 24 inches in the driest soils to 6 inches in high moisture and irrigated situations.

Effect of Seeding Date on Final Stands of Alfalfa, Crested Wheatgrass, and Russian Wild Ryegrass (Swift Current)



— *redrawn from Kilcher, 1961*

Abbreviations:
CWG - Crested Wheatgrass
RWR - Russian Wild Ryegrass
ALF - Alfalfa

Recommended Varieties of Perennial Grasses, 1992

Grass	Varieties	Soil Zones (see map, page 9)	Comments
Bromegrass	Signal	1,2,3, Irr.	North/south type; higher seed yields than Magna and Carlton; similar forage yields.
	Carlton	1,2,3, Irr.	Northern type.
	Magna	1,2,3, Irr.	Southern type with leaf sport resistance; similar to Carlton in hay and seed yields.
	Baylor	1,2,3, Irr.	U.S. variety with satisfactory hay yield.
	Rebound	1,2,3, Irr.	Pasture type; low seed yield.
Meadow Bromegrass	Fleet	3, Irr.	More rapid regrowth than smooth bromegrass; especially good for pastures. Good hay yields in high moisture regions. Fleet and Paddock have higher seed yields than Regar and similar pasture yields.
	Paddock	3, Irr	
	Regar	3, Irr.	
Altai Wild Ryegrass	Prairieland	1,2,3	Saline tolerant; requires extra care in seeding year; retains nutritive value in fall. Eejay and Pearl have improved seed production.
	Eejay	1,2,3	
	Pearl	1,2,3	
Dahurian Wild Ryegrass	James	1 (2,3)	Quick to establish; high yield in seeding year; short lived.
	Arthur	1 (2,3)	Limited data available in zones 2 and 3.
Russian Wild Ryegrass	Tetracan	1,2,3	Large seeded; good seedling vigour; tetraploid.
	Swift	1,2,3	Most seeding vigour; diploid.
	Mayak	1,2,3	Good seed and forage yields; diploid.
	Cabree *	1,2,3	Resistant to seed shattering; good forage and seed yields; diploid.
Crested Wheatgrass	Kirk	1,2,3	Tall, high yielding hay type, good regrowth and seed yield; tetraploid.
	Fairway	2,3, Irr.	Used mainly for roadside seeding; diploid.
	Parkway	2,3, Irr.	Slightly higher yield than Fairway; diploid.
	Nordan	1,2	Does not persist in zone 3, Irr.; tetraploid.
	Summit *	1,2	Does not persist in zone 3, Irr.; tetraploid.
Intermediate Wheatgrass	Chief	1,2,3, Irr.	Higher yielding than Greenleaf; similar to Clarke but less winter hardy.
	Clarke	1,2,3, Irr.	More drought tolerance and higher forage and seed yield than Chief.
	Greenleaf (pubescent)	1,2,3, Irr.	Good seedling vigour and early establishment; does well in moist areas.
Slender Wheatgrass	Revenue	1,2,3	Quick to establish; saline tolerant; short lived; may become coarse; Adanac has higher forage & seed yield than Revenue.
	Adanac **	1,2,3	
Streambank Wheatgrass	Sodar	1,2,3	Yards, waterways, airstrips; drought tolerant; persistent.
Tall Wheatgrass	Orbit	1,2,3	Saline tolerant; winter hardy; may become coarse.
**Reed Canarygrass ** **	Castor *	1,2,3	Flood tolerant; high alkaloid.
	Vantage	1,2,3	Flood tolerant; low alkaloid.
	Venture	1,2,3	Flood tolerant; low alkaloid.
	Rival	1,2,3	Flood tolerant; low alkaloid.
Timothy	Climax	3	Grown mainly for seed production in Saskatchewan; Basho has higher seed yield than Champ and similar forage yield.
	Champ	3	
	Basho	3	
Creeping Red Fescue	Boreal	3, Irr.	Grown mainly for seed production & irrigated pasture mixes.
Kentucky Bluegrass	Troy	Irr.	Component of irrigated pasture mixes.
Orchardgrass	Kay	Irr.	Component of irrigated pasture mixes; not completely winterhardy in Saskatchewan.

* Varieties that have been superseded for general use by new varieties and may be deleted in the future.
** Seed availability limited in 1992.

Recommended Varieties of Perennial Legumes, 1992

Legume	Variety	Soil Zones (see map, page 9)	Comments
Alfalfa	Heinrichs	1.2.3	
	Rambler	1.2.3	
	Rangelander	1.2.3	
	Roamer	1.2.3. Irr.	
	Beaver	2.3 Irr.	
	Anchor	2.3.Irr.	
	OAC Minto	2.3. Irr.	For more information refer to Alfalfa Variety
	Vernal	2.3. Irr.	Characteristics Table on page 5.
	Algonquin	3. Irr.	
	Alouette	3. Irr.	
	Apica	3. Irr.	
	Dekalb	3. Irr.	
	Barrier	Irr.	
	Pioneer 526	Irr.	
	Profit	Irr.	
	Oneida VR	Irr.	
Sweet Clover	Norgold	1.2.3	Yellow blossom; low coumarin.
	Yukon *	1.2.3	Yellow blossom; high coumarin.
Red Clover	Altaswede	3	Both varieties are single cut, grown for seed, forage and
	Norlac	3	ploughdown.
Alsike Clover	Aurora	3	Grown for seed, forage and ploughdown.
	Dawn	3	Grown for seed, forage and ploughdown.
Sainfoin	Melrose *	2.3	Non-bloating; may be short lived.
	Nova	2.3	Non-bloating; may be short lived.
Birdsfoot Trefoil	Cree	3	Non-bloating; higher seed yield than Leo.
	Leo	3	Non-bloating.

* Varieties that have been superseded for general use by new varieties and may be deleted in the future.

For information on seed sources, consult the Sask Seed Growers Association's **Seed Guide** or your local dealer.

Grass - Legume Combinations

Generally, straight alfalfa will produce the highest yield of digestible nutrients of any perennial forage crop. However, grass-legume mixtures are very useful in pastures because of:

- less bloat potential in mixed pasture.
- more uniform supply of forage throughout the growing season.
- more uniform stand over entire pasture.
- productive life of pasture is extended.

Brome-alfalfa is a popular grass-legume mixture. In the higher rainfall areas of the Province brome becomes very aggressive. To maintain a good grass-legume balance in these areas, recommended seeding rates on page 6 can be adjusted to increase the alfalfa and decrease the brome component.

Hay Certification Program

Sask. Feed Testing Laboratory
University of Saskatchewan
General Purpose Building
Saskatoon, SK. S7N 0W0
Phone 966-5620

USE CERTIFIED SEED

Alfalfa Variety Characteristics

Variety	Rooting Patterns	Cold Tolerance or Persistence	Recovery After Cutting	Reaction to Bacterial Wilt	Use
Rambler	Creeping	Very good	Slow	Mod. Resistant	Hay or Pasture
Roamer	Creeping	Very good	Slow	Resistant	Hay or Pasture
Heinrichs	Creeping	Excellent	Slow	Resistant	Hay or Pasture
Rangelander	Very Strongly Creeping	Very good	Slow	Susceptible	Hay or Pasture
Beaver	Tap	Good	Medium	Resistant	Hay
Algonquin	Tap	Good	Medium	Resistant	Hay
Vernal	Tap	Medium	Medium	Resistant	Hay
Anchor	Tap	Medium	Rapid	Resistant	Hay
OAC Minto	Tap	Medium	Rapid	Resistant	Hay
Apica	Tap	Medium	Rapid	Resistant	Hay
Alouette	Tap	Medium	Rapid	Resistant	Hay
Dekalb 120	Tap	Medium	Medium	Resistant	Hay
Barrier *	Tap	Medium	Rapid	Resistant	Irr. Hay
Pioneer 526	Tap	Medium	Medium	Resistant	Irr. Hay
Profit *	Tap	Medium	Medium	Resistant	Irr. Hay
Oneida VR *	Tap	Medium	Medium	Resistant	Irr. Hay

*Resistant to Verticillium Wilt

Alfalfa Cutting Management

Improper management of alfalfa hay stands can lead to winterkill. Understanding alfalfa physiology can help producers avoid this problem.

Carbohydrates are produced in alfalfa leaves and used to fuel plant growth. Excess carbohydrates is moved down to the thick underground crown of the alfalfa plant. This carbohydrate is used as stored fuel, for two purposes: shoot regrowth after cutting, and plant maintenance over winter.

When an alfalfa plant is cut for hay, few leaves remain and the plant must draw on stored carbohydrate for regrowth. As a rule of thumb, the plant will need six weeks to replace the leaves and to replenish stored reserves to pre-cutting levels.

Plants cut after August 15 may not have six weeks of good growing weather to replenish their reserves, and can go into the winter with nearly "empty tanks." If the winter is severe, winter injury can result.

To reduce alfalfa winter kill:

- avoid cutting between Aug. 15 and first killing frost
- seed recommended, winterhardy varieties
- inoculate seed properly and maintain adequate soil phosphorus
- manage stubble for maximum snowcover

Weatheradio Canada

Location	VHF Frequency	Telephone
Meath Park	162.400 MHZ	929-2114
Midale	162.400 MHZ	634-2833
N. Battleford	162.475 MHZ	445-7000
Regina	162.550 MHZ	780-5744
Saskatoon	162.550 MHZ	975-4266
Stranraer	162.400 MHZ	463-2031
Swift Current	162.550 MHZ	773-5599
Yorkton	162.550 MHZ	782-1511
Regina Beach	162.400 MHZ	780-5564

Recommended Seeding Rates for Various Soil Zones

Soil Zone (see map on page 9)	Crops	Row Spacing Inches	Row Spacing Cm	Seeding Rate lb./acre or kg/ha
1. Brown	Hay Crops (seed grass and legume in alternate rows)			
	Crested wheatgrass & alfalfa	18-24	45-60	3 + 2
	Intermediate wheat grass & alfalfa	18-24	45-60	4 + 2
	Alfalfa	18-24	45-60	4
	Sweetclover	6	15	8
	Pastures (cross-seed grass & legume)			
	Altai wild ryegrass & alfalfa (high water table or saline seep areas only)	18-24	45-60	8 + 2
	Crested wheatgrass & alfalfa	18-24	45-60	3 + 2
	Russian wild ryegrass & alfalfa	18-24	45-60	3 + 2
2. Dark Brown	Hay Crops (alternate rows)			
	Bromegrass & alfalfa	12-18	30-45	8 + 2
	Crested wheatgrass & alfalfa	12-18	30-45	5 + 2
	Intermediate wheatgrass & alfalfa	12-18	30-45	8 + 2
	Alfalfa	12-18	30-45	8
	Sweetclover	6	15	8
	Pastures (cross-seeded if possible)			
	Altai wild ryegrass & alfalfa (high water table or saline seep areas only)	18-24	45-60	8 + 2
	Bromegrass & alfalfa	12-18	30-45	8 + 2
	Crested wheatgrass & alfalfa	18-24	45-60	4 + 2
	Russian wild ryegrass & alfalfa	18-24	45-60	3 + 2
	Alfalfa (Caution - risk of bloat)	12-18	30-45	8
3. Black and Grey-wooded	Hay Crops			
	Bromegrass & alfalfa	12	30	8 + 3
	Crested wheatgrass & alfalfa	12	30	6 + 3
	Intermediate wheatgrass & alfalfa	12	30	11 + 3
	Alfalfa	12	30	8
	Sweetclover	6	15	8
	Meadow bromegrass	12	30	12
	Meadow bromegrass & alfalfa	12	30	10 + 2
	Pastures			
	Bromegrass & alfalfa	12	30	8 + 2
	Crested wheatgrass & alfalfa	12	30	6 + 2
	Intermediate wheatgrass & alfalfa	12	30	11 + 2
	Meadow bromegrass & alfalfa	12	30	10 + 2
	Meadow bromegrass	12	30	12
	Russian wild ryegrass	12	30	6
	Sainfoin (non-bloating)	12	30	30
	Birdsfoot trefoil (non-bloating)	6	15	4
Irrigation	Hay Crops			
	Bromegrass & alfalfa	6	15	8 + 5
	Intermediate wheatgrass & alfalfa	6	15	11 + 5
	Alfalfa	6	15	8-10
	Meadow bromegrass	6	15	12
	Meadow bromegrass & alfalfa	6	15	10 + 2
	Pastures			
	Meadow bromegrass & alfalfa	6	15	10 + 2
	Brome grass & alfalfa	6	15	8 + 3
	Intermediate wheatgrass & alfalfa	6	15	11 + 3
	Kentucky bluegrass & alfalfa	6	15	2 + 3
	Meadow bromegrass	6	15	12
	Orchardgrass	6	15	10

Notes:

- Seeding rates may be varied based on seed quality and cost, seeding conditions and end use of the crop.
- Other mixtures of the above species may be developed using information on page 16. When seeding grass alone for pasture in the brown and dark-brown soild zones, increase grass recommended rate by 1.5 x. If Tetracan Russian wild ryegrass is used increase seeding rate by 2 x. If Fairway or Parkway crested wheatgrass is used reduce seeding rates by 20%. Higher seeding rates may be appropriate where alfalfa is sown for dehy, or where a thick stand of fine stemmed alfalfa is required. However, research in Saskatchewan, Manitoba and North Dakota indicates that seeding more than about 8 lb/a does not result in greater forage yields.

Inoculation of Legumes

Inoculation is the addition of effective rhizobium bacteria to legume seed prior to planting. After germination, the bacteria form nodules on the roots and begin taking nitrogen (N) gas from the soil air. They convert the gas to ammonium and give it to the plant. Well nodulated forage legumes can grow vigorously without the need for commercial nitrogen fertilizer.

Many Saskatchewan soils lack the specific rhizobia needed for rapid growth and high yields of forage legumes. Inoculation corrects these deficiencies by sticking thousands of highly effective N-fixing bacteria to each seed just before planting. The cost of inoculant is low and the potential yield benefits are substantial.

Each legume or group of legumes requires a unique species of rhizobium to form nodules and fix nitrogen. Commercial inoculants are prepared for specific legumes. Make sure you get the right one for your crop.

Methods of Inoculation

Inoculant is a dry powder that is mixed with the seed just prior to planting. In order to be effective, it must be "glued" to the seed, so a sticker solution is used to bind the two together. Sticking agents like diluted sugar water, molasses, soda pop, etc., are used, but research has shown that a solution of ordinary powdered skim milk is very effective. If you use calf feed use a formulation without antibiotic.

Precise amounts of sticker are not important. Just mix the skim milk according to package directions (do not use hot water). Dribble (or spray) the milk onto the seed, wetting it thoroughly, and let the excess milk drain off. Turning the seed during this operation will ensure complete wetting.

Add inoculant to the wetted seed. Follow manufacturer's instructions for proper amounts. If you plan to broadcast seed, or if seeding conditions are not ideal, increase the amount. Many growers routinely double the recommended rate of inoculant. Stir the seed and inoculant thoroughly, then proceed with seeding as quickly as possible.

Small batches of wetted seed can be inoculated manually by mixing seed and inoculant in a large container or on a polyethylene sheet. For larger amounts of seed, cement mixers or ice augers can be used for mixing.

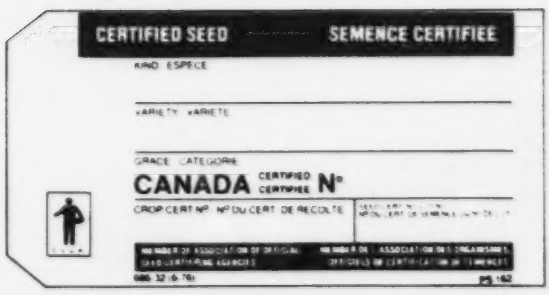
Some manufacturers are now combining inoculant and sticker, either in a "double bag" system or with the sticker as a component of the inoculant.

Guide to Successful Inoculation

- Inoculate seed with the correct rhizobium.
- Use a sticker.
- Store inoculant in a cool dry place until use.
- Do not expose to direct sunlight.
- Inoculate seed just before seeding.
- Do not mix fertilizer with inoculated seed.
- Sow inoculated seed into a moist seedbed.
- Use more inoculant under adverse conditions.

Pre-inoculated Seed

Pre-inoculated seed of major forage legumes is now commercially available. The rhizobial quality of these more convenient seed products has considerably improved in recent years. Pre-inoculated seed should be planted soon after purchase, since the inoculant may suffer drastic loss in viability after just a few weeks of springtime storage. Seed should be manually re-inoculated if seeding is delayed by several weeks.



Crop Certificate Number
The first two digits represent the year in which the crop was produced.
The third to the ninth digits inclusive represent the identification number of the grower who produced the seed.
The tenth digit represents the code for the generation or class issued to the crop which produced the seed.
The eleventh digit represents the number of different certificates of the same status issued to the grower.

Seed Certificate Number
This number is assigned by Agriculture Canada for each lot of seed tagged by a Seed Inspector. There is a different number for each lot of seed.

Annual Crops for Forage

Annuals can provide good forage value and are particularly useful in times of feed or pasture shortage. However, long-term economics suggest the bulk of forage needs should be met with perennials, using annuals only for specialized or shortage situations.

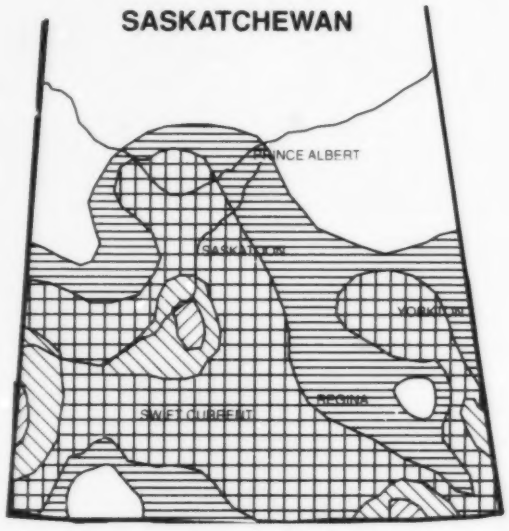
Annuals can be used for pasture, and fit well into grazing management systems (see page 13). The choice of crop depends on when the additional pasture is required: fall rye sown in late August to early September will provide early grazing the next spring, and oats, barley, wheat, spring rye or triticale sown in the spring is ready for pasturing about seven weeks after planting. Spring-seeded fall rye or winter wheat will not go to seed, and yield abundant leaf growth for mid and late-season grazing providing moisture is adequate. Some producers have experimented with minor use annuals such as sorghum-sudangrass, millet and kochia.

High stocking rates (two cow/calf pairs or three steers per acre) plus rotational grazing will ensure good annual pasture productivity.

Annual Crop Varieties

		Soil Zones
Oats	any recommended variety	1,2,3,Irr.
Wheat	any recommended variety	1,2
Fall rye	any recommended variety	1,2,3
Barley	Bonanza or any smooth awn variety	1,2,3,Irr.
Faba beans	any recommended variety	3,Irr.
Corn	as listed below	

Average Number of Heat Units Received



Recommended Varieties of Corn for Silage in Saskatchewan, 1992

Variety recommendations are based on climatic heat units. See the map above to determine heat unit rating for your area.

Heat Unit Rating	Brand & Hybrid Name	Days to 50% Silking	Percentage of Stalk Breakage	Percentage Moisture	Tonnes/ha (Dry)
Below 2300 Heat Units	Dekalb DK246	90	17.0	63.6	7.6
	PAG SX 104	87	15.3	64.6	8.9
	Pickseed 2435	83	10.9	62.3	8.4
	Pickseed 2477	85	10.2	66.6	9.2
	Pioneer 3994	84	15.5	64.9	7.9
	Pioneer 3995	82	34.8	63.8	8.2
	Pioneer 3996	87	8.5	63.8	8.2
Above 2300 Heat Units	Dekalb DK24	92	10.1	66.9	8.7
	Dekalb T778	95	19.9	65.4	8.9
	PAG SX 95	91	14.1	64.5	8.7
	Pioneer 3953	92	NA	65.6	9.4
	Pioneer 3969	88	22.5	65.4	9.0

Treat seed with a recommended dual-purpose fungicide.

Fertilizing Forages

The following are guidelines which may be used to plan fertilizer programs in the absence of a soil test. The suggested rates reflect the long term experience of the Saskatchewan Soil Test Lab. Large variations in fertility can occur between fields, so accurate estimates can only be obtained with a soil test.

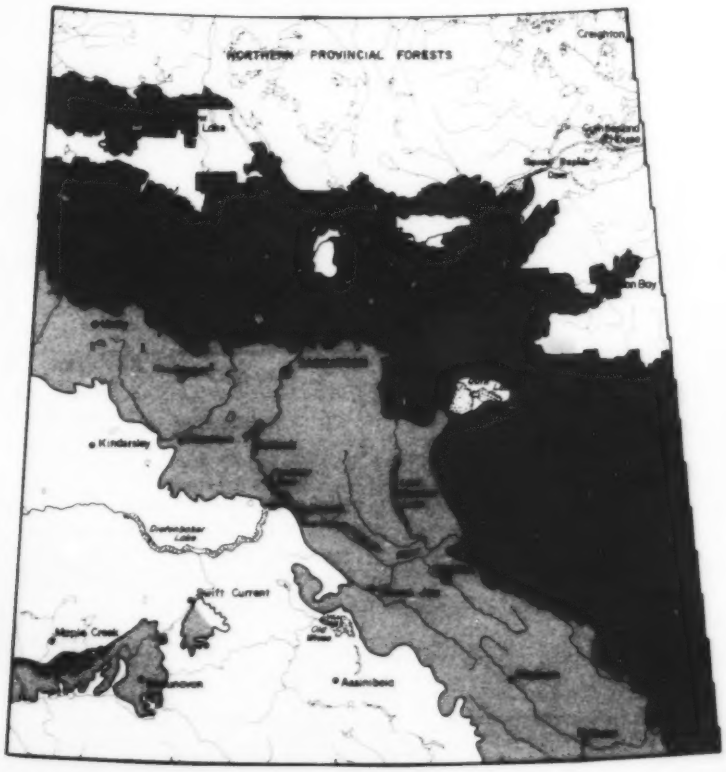
The rates for nitrogen are defined for normal soil moisture conditions.

Phosphorus moves very slowly in soil, so for best results it should be pre-incorporated.

Rates for potash and sulphur are for course textured well-drained soils in the more humid regions of the province. On other soils these nutrients should only be applied on the basis of a valid soil test. Sulphur should be used on Gray Wooded soils, particularly when seeding legumes.

General Fertilizer Recommendations

Crop	Soild Zone	Nitrogen lb/a (kg/ha) Actual N	Phosphate lb/a (kg/ha) Actual P_2O_5	Potash lb/a (kg/ha) Actual K_2O	Sulphur lb/a (kg/ha) Actual S
Cultivated grasses and Grass - legume mixtures	- Brown and Dark Brown	30-70 (35-80)	0-20 (0-20)		
	- Black and Gray	30-90 (35-100)	0-40 (0-40)	0-35 (0-40)	0-20 (0-20)
	- Irrigation	80-160 (90-175)	0-40 (0-45)		
Legumes	- Brown and Dark Brown	Inoculate	20-30 (20-35)		
	- Black, Gray	Inoculate	30-40 (35-45)	0-35 (0-40)	0-25 (0-30)
	- Irrigation (all zones)	Inoculate	40-60 (45-65)		



Forage Crop - Soil Zones of Saskatchewan

1. Brown
2. Dark Brown
3. Black - Gray-Wooded

Soil Testing Laboratory
University of Saskatchewan
General Purpose Building
Saskatoon, SK S7N 0W0
Phone 966-6890

Methods of Fertilizer Application and Placement

Nitrogen N	Phosphorus P_2O_5	Potash K_2O	Sulphur S
GRASSES **New Seeding:** Broadcast and incorporate or deep band prior to seeding. Inoculate legume seed. **Established Stands:** Broadcast ammonium nitrate (34-0-0) in fall or spring. Urea (46-0-0) and ammonium sulphate (21-0-0) last week in Oct. or very early spring. Adding N may reduce proportion of legume stand.	**New Seeding:** If seed row spacing is 6 in. (15 cm) up to 15 lb/ac (15 kg/ha) may be seed placed. At higher rates, broadcast and incorporate or deep band or sideband. Sidebanding is best if row spacing is 30 cm (12 in) or more. **Established Stands:** Broadcast in fall or early spring for pasture or hay. Broadcast after harvest for seed production.	**New Seeding:** Broadcast and incorporate or sideband. **Established Stands:** Broadcast at same time as nitrogen.	**New Seeding:** Broadcast and incorporate, deep band, or side band. **Established Stands:** Broadcast at same time as nitrogen.
LEGUMES: **New Seeding:** Inoculate seed. If recommended by soil test, broadcast and incorporate deep band, or sideband a small amount of N.	**New Seeding:** Up to 15 lb/ac (15 kg/ha) may be seed placed. For higher rates, broadcast and incorporate or deep band prior to seeding or sideband. **Established Stands:** Broadcasting P in fall or early spring improves alfalfa yield and longevity.	**New Seeding:** Sideband or broadcast and incorporate. **Established Stands:** Broadcast at same time as phosphorus.	**New Seeding:** Sideband, broadcast or deep band. **Established Stands:** Broadcast at same time as phosphorus.

For more complete information about fertilization practices see the bulletin
General Recommendations for Fertilization in Sask.

Source of Nitrogen

Established grass stands should be fertilized with granular fertilizers. Experiments have shown granular fertilizers are the most effective nitrogen sources for grasses. Spraying nitrogen solutions, particularly those containing urea, on forage is unsatisfactory and not recommended. Response to nitrogen fertilizers depends upon time of application, amount applied, type of nitrogen fertilizer, age of stand, species of grass, number of cuts taken and climatic conditions. In Saskatchewan urea (and dry fertilizers containing urea) is usually less effective than ammonium nitrate. The relative effectiveness of the various fertilizers when broadcast urea is given a value of 100 are:

	Relative Value
Ammonium nitrate broadcast	110-120
Urea broadcast	100

Time of Application

Grass for Hay or Pasture. Grass for hay and pasture should be fertilized in early spring (as soon as fields are sufficiently dry in April or early May), or late fall. Fertilizer should not be applied to frozen soils that are subject to water run-off. The average relative values of time of application when early spring broadcast nitrogen is given a value of 100 are:

Time	Relative Value
Spring	100
Fall	80

Split application of nitrogen during the growing season as compared to a single large application in early spring results in more efficient use of the applied nitrogen. Splitting a fertilizer application will not increase forage yields above single application levels, but the forage protein content is improved with split application. Split applications of less than 45 lb N/ac (50 kg/ha) total are not recommended.

Herbicides used in grasses and legumes

	Herbicide	Grasses															Legumes								Cover Crop				
	Consult the label for final detailed instructions.	Altai wild ryegrass	Brome grass	Creeping red fescue	Crested wheat grass	Inter. wheat grass	Kentucky blue grass	Meadow fescue	Meadow foxtail	Orchard grass	Reed canary grass	Russian wild rye grass	Slender wheat grass	Tall wheat grass	Timothy	Alfalfa	Alsike clover	Bird's-foot trefoil	Cicer milkvetch	Red clover	Sainfoin	Sweet clover	White clover	Barley	Canola	Flax	Oats	Wheat
SEEDLING STAND	Advance 10G															SD F								X	X	X		
	Assure															SD									X	X		
	Avadex BW[1]															F SD	F SD	F SD		F SD		F SD	F SD	X	X	X		X
	Avenge[1]		F SD	F SD	F SD		F SD	F SD		F SD	F SD	F SD			F SD	F SD		F SD		F SD		F SD		X				X[2]
	Basagran		SD	SD	SD				SD	SD					SD	SD	SD			SD	SD					X			
	Buctril M		SD	SD	SD	SD		SD		SD	SD	SD	SD	SD	SD									X		X	X	X
	Edge															SD									X			
	Cobutox/Embutox/ Butyric 400/SEE 2,4-DB															SD F	SD F	SD F		SD F			SD F	X			X	X
	Eptam															SD F		SD F										
	Fusilade/Fusilade II			SD F												SD F		SD F		SD F					X	X		
	Hoe-Grass		SD F	SD F	SD F	SD F						SD F				SD F	SD			SD F	SD	SD F		X[3]	X	X		X
	Hoe-Grass II		SD	SD	SD	SD						SD												X[3]		X		X
	Lontrel	SD F	SD F	SD F	SD F	SD F	SD F	SD F	SD F	SD F	SD F	SD F	SD F	F	SD F									X	X	X	X	X
	Mataven		SD	SD	SD	SD		SD				SD				SD		SD	SD	SD	SD							X[3]
	Pardner		SD	SD	SD	SD		SD		SD	SD	SD	SD	SD	SD									X			X	X
	Poast			SD												SD F	SD		SD		SD	SD			X	X		
	Rival[4]																				SD F	SD F		X	X			
	Treflan															SD F					SD[4] F	SD[4] F		X	X			
	Tropotox Plus																SD F			SD F			SD F	X			X	X
	2,4-D amine	SD F	SD F	SD F	SD F	SD F	SD F	SD F	SD F	SD F	SD F	SD F	SD F	SD F	SD F									X				X
ESTABLISHED STAND	Assure															SD												
	Fusilade/Fusilade II			SD F												SD F		SD F		SD F								
	Kerb[5]	F	F	F	F	F	F	F	F	F	F	F	F	F		SD F		SD F										
	Lontrel	SD F	SD F	SD F	SD F	SD F	SD F	SD F	SD F	SD F	SD F	SD F	SD F	F	SD F													
	Poast			SD												SD F	SD		SD		SD	SD						
	Princep/Simazine[6]															SD F		SD F										
	Velpar L[7]															SD												
	2,4-D amine	F	F	F	F	F	F	F	F	F	F	F	F	F	F													

SD - product is recommended when crop grown for seed

F - product is recommended when crop grown for forage

X - product is recommended for cover crop

1 use only when forage seedlings are underseeded in crops for which herbicide is registered

2 Benito, Canuck, Chester, Columbus, Conway, Fielder, Glenlea, HY 320, Genesis, Katepwa, Kenyon, Lancer, Leader, Macoun, Neepawa, Oslo, Selkirk

3 check recommendations for varietal restrictions

4 spring application only

5 established grasses, seeded at least 2 years prior to application

6 apply in late fall prior to freeze-up

7 apply to alfalfa established at least 18 months

NOTE: For information regarding grazing and feeding restrictions refer to product label or section on page 127.

Seeding Forages in Saline Areas

Saline patches that appear in grain fields may steadily enlarge if annual cropping continues. Converting this land to forages is much more successful if done while the affected land still supports barley crop production.

Late fall seeding of saline areas is desirable, since early spring snowmelt temporarily decreases salinity concentrations.

Seeding mixtures of two, three or even four varieties of grasses and legumes is recommended. Non-saline tolerant species (alfalfa, crested wheatgrass) should be included in salinity mixtures so they can establish around seep edges and in pockets of better soil.

Nearby water recharge areas should be identified and seeded to taprooted alfalfa.

Perennial Forage Crops for Saline Soils, Flooded Areas and Peat (6 inch row spacings)

Salinity Rating *	Crop or Mixture	Approximate Seeding Rate for hay or Pasture lb/acre or kg/ha
	Soils with Minor Spring Flooding (up to 2 Weeks)	
Slight to Moderate (2-6 mmhos.)	Bromegrass + Russian wild ryegrass + alfalfa (creeping rooted)	4+4+4
	Bromegrass + slender wheatgrass + alfalfa (creeping rooted)	4+4+4
	Russian wild ryegrass + alfalfa	6+3
	Altai wild ryegrass + alfalfa	10+3
	Crested wheatgrass + alfalfa	7+3
	Altai wild ryegrass	11
	Slender wheatgrass + sweetclover (Short-term stands and not over 1 week flooding)	8+6
Severe (6-15 mmhos.)	Bromegrass + Russian wild ryegrass + slender wheatgrass	4+4+4
	Crested wheatgrass + Altai wild ryegrass + tall wheatgrass + alfalfa	4+4+4+2
	Altai wild ryegrass + alfalfa	10+3
	Tall wheatgrass (moist districts or seepage areas)	12
	Spring Flooded (2-5 Weeks)	
Little or none (up to 2 mmhos.)	Reed canarygrass + bromegrass	4+6
	Reed canarygrass + timothy	4+4
	Timothy + bromegrass	4+6
	Altai wild ryegrass + alfalfa (2-3 weeks maximum flooding)	10+3
	Altai wild ryegrass	11
	Timothy + alsike	5+2
Slight to moderage (2-6 mmhos.)	Reed canarygrass + bromegrass	4+6
	Reed canarygrass + bromegrass + slender wheatgrass	4+6+6
	Altai wild ryegrass + alfalfa	10+3
	Altai wild ryegrass	11
Severe (6-15 mmhos.)	Altai wild ryegrass + alfalfa	10+3
	Slender wheatgrass	8
	Altai wild ryegrass	11
	Tall wheatgrass	12
	Spring Flooded (5-8 Weeks)	
Little or none (up to 2 mmhos.)	Reed canarygrass	5
	Reed canarygrass + timothy + slender wheatgrass	3+3+6
Slight to moderate (2-6 mmhos.)	Reed canarygrass + slender wheatgrass	4+6
	Tall wheatgrass	12
	Peat, Poorly Drained Soils	
	Timothy + alsike clover	5+2
	Timothy + bromegrass + slender wheatgrass + alsike	3+5+5+2
	Timothy + bromegrass + alsike	3+6+2
	Reed canarygrass + timothy	4+3

* Ratings for salt content in millimhos per centimetre conductivity. Salt content reading can only be determined by obtaining a soil test from the Saskatchewan Soil Testing lab in Saskatoon.

Improved Grazing Management: More Pasture for More Months

A grazing system is a planned grazing program which uses all forage pasture resources to ensure high cattle performance at acceptable costs and risks, while improving or at least maintaining pasture productivity.

The grazing system should satisfy the following goals:

- balance the number of animals with available forage supply
- obtain a uniform distribution of animals over the range
- alternate periods of grazing and test
- leave adequate carryover for regrowth and ground cover.

Native and introduced species respond differently to environmental and physical factors. Native prairie grasses grow slowly in the spring and are relatively low yielders. They give the best yields when grazing is deferred until mid-June or later. Native pasture is damaged by grazing too early.

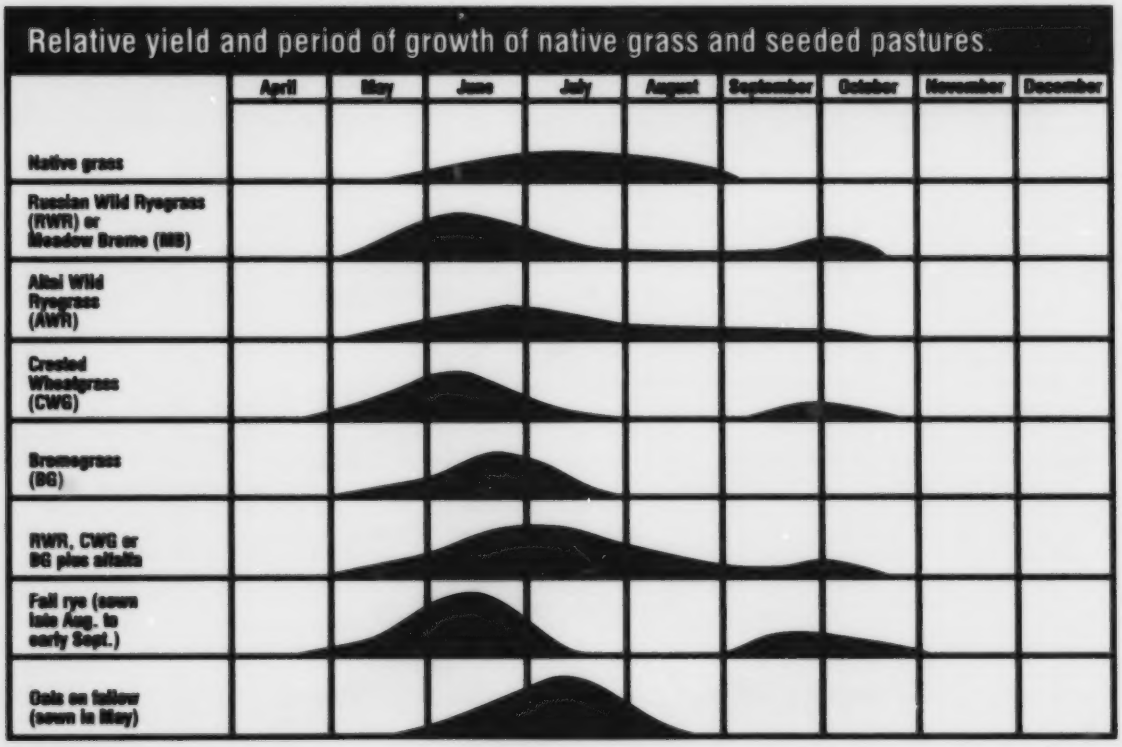
Crested wheatgrass starts growth early in spring and grows very rapidly in may and June. Bromegrass and alfalfa growth is greatest in June and July. Russian wild ryegrass and Altai wild ryegrass have a longer period of growth and maintain good palatability and nutrient value through the summer and into late fall.

A carryover of 150-200 lb/a of the current year's total growth is recommended to maintain a productive pasture. This is equivalent to about 45% of the average season's growth of native pasture or 30% of an introduced species such as crested wheatgrass.

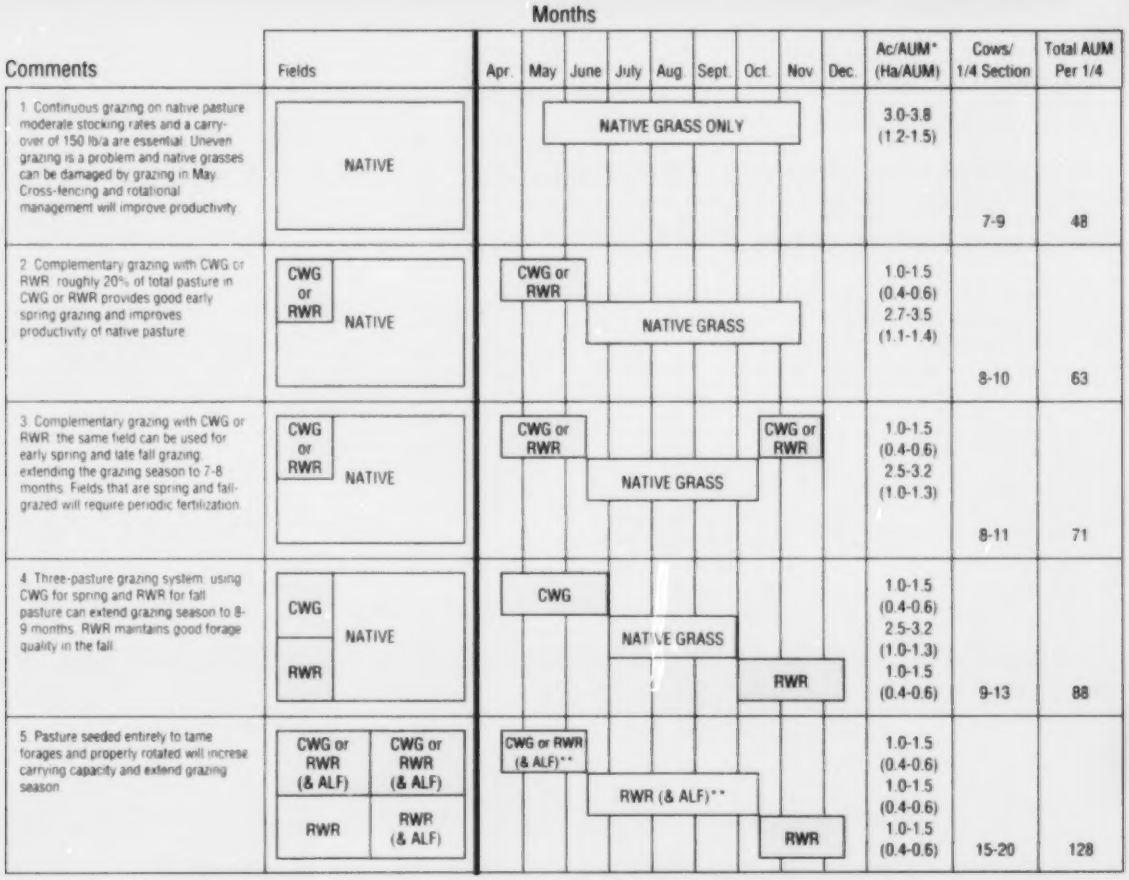
Starting from a base of continuous grazing of native pasture, various improvements can be introduced:

- Provide sufficient spring grazing on cultivated annual or perennial forage to delay grazing of native pasture until June 15.
- Establish Russian or Altai wild ryegrass pastures to lengthen fall grazing season.
- Add annuals for summer pasture (see page 8).
- Cross-fence pastures to develop a rotational grazing system, (deferred, short duration, Savory, etc.) based on complementary use of pasture types available.

Some examples of grazing systems are shown on pages 14 and 15.



Grazing Systems for Brown & Dark Brown Soil Zones


Months
Comments
Fields
Apr.
May
June
July
Aug.
Sept.
Oct.
Nov
Dec.
Ac/AUM* (Ha/AUM)
Cows/ 1/4 Section
Total AUM Per 1/4
1. Continuous grazing on native pasture moderate stocking rates and a carry-over of 150 lb/a are essential. Uneven grazing is a problem and native grasses can be damaged by grazing in May. Cross-fencing and rotational management will improve productivity.
NATIVE
NATIVE GRASS ONLY
3.0-3.8 (1.2-1.5)
7-9
48
2. Complementary grazing with CWG or RWR: roughly 20% of total pasture in CWG or RWR provides good early spring grazing and improves productivity of native pasture.
CWG or RWR
NATIVE
CWG or RWR
NATIVE GRASS
1.0-1.5 (0.4-0.6) 2.7-3.5 (1.1-1.4)
8-10
63
3. Complementary grazing with CWG or RWR: the same field can be used for early spring and late fall grazing extending the grazing season to 7-8 months. Fields that are spring and fall-grazed will require periodic fertilization.
CWG or RWR
NATIVE
CWG or RWR
NATIVE GRASS
CWG or RWR
1.0-1.5 (0.4-0.6) 2.5-3.2 (1.0-1.3)
8-11
71
4. Three-pasture grazing system: using CWG for spring and RWR for fall pasture can extend grazing season to 8-9 months. RWR maintains good forage quality in the fall.
CWG
RWR
NATIVE
CWG
NATIVE GRASS
RWR
1.0-1.5 (0.4-0.6) 2.5-3.2 (1.0-1.3) 1.0-1.5 (0.4-0.6)
9-13
88
5. Pasture seeded entirely to tame forages and properly rotated will increse carrying capacity and extend grazing season.
CWG or RWR (& ALF)
CWG or RWR (& ALF)
RWR
RWR (& ALF)
CWG or RWR (& ALF)**
RWR (& ALF)**
RWR
1.0-1.5 (0.4-0.6) 1.0-1.5 (0.4-0.6) 1.0-1.5 (0.4-0.6)
15-20
128

Abbreviations:
ALF — Alfalfa, CWG — Crested Wheatgrass, RWR — Russian Wild Ryegrass, AUM — Animal Unit Month

* Stocking rates are based on pasture in good condition.
** The addition of alfalfa to a spring or summer pasture can increase carrying capacity a further 20 to 50%.

The Animal Unit Month (AUM) Concept

The AUM concept is very useful for planning grazing strategies. One AUM is defined as one 1000 lb cow (with calf at foot) grazing for one month. Thus a quarter section that is rated at 48 AUM can carry 8 cows for 6 months. Alternately, the pasture can carry 12 cows for 4 months, or any other combination that works out to 48 AUM.

Livestock are rated as follows:

1 1000 lb cow (w/calf)	1.0 AUM
1 yearling steer or heifer	.65-.75
1 bull	1.5
1 horse	1.5
5 ewes (w or w/o lambs)	1.0

For larger cows, AUM value is adjusted upward (example: cows averaging 1200 lbs would equal 1.2 AUM).

Grazing Systems for the Black & Gray Wooded Soil Zones

Comments	Fields	Months: Apr.	May	June	July	Aug.	Sept.	Oct.	Nov	Dec.	Ac/AUM* (Ha/AUM)	Cows/ 1/4 Section	Total AUM Per 1/4
1. Grazing bush pastures before mid-June will reduce long-term carrying capacity.	BUSH PASTURE			BUSH PASTURE							6.4-15.8 (2.6-6.4)	10-25	60
2. Seeding about 20% of the area to CWG or other spring forage and fencing for rotational grazing control will extend grazing season. CWG fields that are spring and fall-grazed will require periodic fertilization.	CWG; BUSH PASTURE		CWG**		BUSH PASTURE		CWG				2-2.7 (0.8-1.1) 5.2-10.6 (2.1-4.3)	12-22	85
Rejuvenating 20% of old stands and rotating stock will increase carrying capacity and extend grazing season.	CWG; DEPLETED TAME PASTURE		CWG**		DEPLETED TAME PASTURE		CWG				2-2.7 (0.8-1.1) 4-5.4 (1.6-2.2)	18-26	110
4. Rotational grazing and tame forages such as these will probably be the most economical of all grazing methods.	CWG & ALF; MB & ALF; MB & ALF; CWG & ALF		CWG & ALF**		MB & ALF		CWG & ALF				2-2.7 (0.8-1.1) 2.3-3.2 (.9-1.3) 2-2.7 (0.8-1.1)	26-36	150

Abbreviations: ALF — Alfalfa, CWG — Crested Wheatgrass, RWR — Russian Wild Ryegrass, AUM — Animal Unit Month

* Stocking rates are based on pasture in good condition.
** The addition of alfalfa to a spring or summer pasture can increase carrying capacity a further 20 to 50%.

Bloat

Bloat is a potentially lethal expansion of the stomach in ruminant animals, which can occur after they have eaten large quantities of legume forage. Legumes can create a stable foam in the rumen, which blocks the normal escape of gas.

Fear of bloat causes many producers to avoid use of forage legumes; however, most of the specific situations that cause bloat can be avoided.

- Do not turn livestock directly on to a lush, vigorously-growing legume field. Make sure the animals are already fed when they go on, and avoid putting them on in the morning, when dew increases plant moisture content.
- Seed pastures to a mixture of grasses and legumes, to reduce legume intake.
- In high-risk situations, feed bloat control products containing poloxalene.
- Consider use of non bloating legumes (sainfoin) or low-growing types (certain clovers, cicer milkvetch).

Certain breeds and strains of livestock seem to be prone to bloat. Bloated animals can be saved if prompt action is taken, in consultation with a veterinarian.

Sask. Feed Testing Laboratory
University of Saskatchewan
General Purpose Building
Saskatoon, SK S7N 0W0
phone 966-5820

Nitrate Poisoning

Frosted green oats can cause nitrate poisoning. Barley, wheat, corn, flax sorghum and other forages, and some weeds, such as lamb's quarters, kochia and Russian thistle, can also contribute.

Plants take up nitrogen largely in the form of nitrate. Under favorable growing conditions, the plant quickly converts nitrate to non-toxic compounds. Poor growing conditions (drought or frost) can cause nitrate to accumulate. When conditions improve and the plant starts growing again, nitrates are quickly used up.

When livestock consume forage containing nitrate, their ability to absorb oxygen is reduced. Symptoms of mild nitrate poisoning included restlessness, frequent urination and watery eyes. Acute poisoning causes extreme weakness, blue coloration of eyes and mouth, shortness of breath, and finally death. Nitrate poisoning can be treated by prompt injection by a veterinarian of aqueous methylene blue.

Nitrate poisoning can be avoided by taking these precautions:

- Feed animals first before turning them out on lush annual pasture or cereal aftermath.
- Check the herd frequently during initial period and consider supplementary feeding.
- Have stored hay, especially frozen cereal forage, analyzed by the Feed Test Laboratory. It is a good management practice to have all forages analyzed.
- Feed containing 0.5% or more nitrate is considered dangerous. The hazard can be reduced by mixing high nitrate feed with other fodder.

Comparative Seed Size of Most Forage Crops

Crop	Approx No. of Seeds/kg	Approx. No of Seeds/lb.
LEGUMES		
Alfalfa	440,000	200,000
Sweetclover	572,000	260,000
Alsike clover	1,540,000	700,000
Red clover	605,000	275,000
White clover	1,760,000	800,000
Bird's-foot trefoil	825,000	375,000
Sainfoin	66,000	30,000
Cicer milkvetch	286,000	130,000
GRASSES		
Russian wild ryegrass (diploid)	385,000	175,000
Russian wild ryegrass (tetraploid)	220,000	100,000
Altai wild ryegrass	112,000	51,000
Crested wheatgrass (diploid)	485,000	220,000
Crested wheatgrass (tetraploid)	385,000	175,000
Daburian wild ryegrass	175,000	80,000
Northern wheatgrass	341,000	155,000
Western wheatgrass	242,000	110,000
Intermediate wheatgrass	194,000	88,000
Pubescent wheatgrass	220,000	100,000
Slender wheatgrass	352,000	160,000
Streambank wheatgrass	344,000	156,000
Tall wheatgrass	174,000	79,000
Kentucky bluegrass	4,800,000	2,182,000
Smooth bromegrass	300,000	136,000
Meadow bromegrass	176,000	80,000
Creeping red fescue	1,353,000	615,000
Meadow fescue	506,000	230,000
Tall fescue	500,000	227,000
Meadow foxtail	1,270,000	577,000
Creeping foxtail	1,657,000	753,000
Orchardgrass	1,439,000	654,000
Timothy	2,710,000	1,232,000
Reed canarygrass	1,175,000	534,000

Calculating Seeding Rates

For Individualized seeding rates, the following information may be of assistance. If you are aiming for 20-30 seeds per linear foot of row you will need to know the number of seeds per pound of forage crop as listed above. The number of linear feet per acre will be determined by row spacing as indicated in the table below.

Row Spacing	Linear Feet/a
6"	87,120
12"	43,560
18"	29,040
24"	21,780
X"	43,560 x 12 ÷ X

Sample Calculations

1. Straight alfalfa in high moisture area with 6" row spacing:
   $\frac{87,120 \text{ linear feet/a} \times 20 \text{ seeds/linear foot}}{200,000 \text{ seeds/lb}}$ = 9 lb/a
2. Straight alfalfa in high moisture area with 12" row spacing:
   $\frac{43,560 \text{ linear feet/a} \times 30 \text{ seeds/linear foot}}{200,000 \text{ seeds/lb}}$ = 7 lb/a
3. Tetraploid crested wheatgrass with alfalfa in same row with 18" row spacing:
   CWG - $\frac{29,040 \text{ linear feet/a} \times 15 \text{ seeds/linear foot}}{175,000 \text{ seeds/lb}}$ = 3 lb/a
   Alfalfa - $\frac{29,040 \text{ linear feet/a} \times 15 \text{ seeds/linear foot}}{200,000 \text{ seeds/lb}}$ = 2lb/a

Other forages can be calculated on the same basis. For mixtures in the same row, the sum of all seeds in the row should be in the range of 20 to 30 seeds per linear foot of row. For alternate rows of different forages species, or for cross seeding, each forage species should be considered individually when determining seeding rate per acre.

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